DOLI Virginia Occupational Safety and Health VOSH

**VOSH PROGRAM DIRECTIVE**: **14-409** **ISSUED**: **December 15, 1998**
**REISSUED: April 1, 2003**

**SUBJECT**: **Special Emphasis Program (SEP) for Silicosis**

**A**. **Purpose**.

This revision updates old references and renumbers this LEP to conform to the new VOSH program directives' classification and numbering system (see VOSH Program Directive 01-001A).

This directive continues inspection targeting guidance for implementing a federal Special Emphasis Program (SEP) to reduce and eliminate the workplace incidence of silicosis from exposure to crystalline silica. Inspections initiated under this SEP shall be scheduled and conducted in accordance with the provisions in the VOSH Field Operations Manual.

*This Program Directive is an internal guideline, not a statutory or regulatory rule, and is intended to provide instructions to VOSH personnel regarding internal operation of the Virginia Occupational Safety and Health Program and is solely for the benefit of the program. This document is not subject to the Virginia Register Act or the Administrative Process Act; it does not have general application and is not being enforced as having the force of law.*

**B**. **Scope**.

This directive applies to all VOSH personnel, and specifically to Health Compliance personnel.

**C**. **Reference**.

Memorandum from Joseph A. Dear, Assistant Secretary for OSHA, dated May 2, 1996.

**D**. **Cancellation**.

Not Applicable.

**E**. **Action**.

Directors and Managers shall assure that the procedures established in this directive are adhered to in the scheduling of programmed inspections and in the coding for emphasis

programs on the VAOSH-1 form.

**F**. **Effective Date**.

April 1, 2003

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C. Ray Davenport
Commissioner

Attachment: Memorandum from Joseph A. Dear, Assistant Secretary for OSHA, dated May 2, 1996 or refer to: http://www.osha-slc.gov:80/Silica/SpecialEmphasis.html

Distribution: Commissioner of Labor and Industry
Directors and Managers
VOSH Compliance Staff
Cooperative Programs Staff
Legal Support Staff
OSHA Regional Administrator, Region III
OSHA Regional Office, Norfolk

When the instructions, as set forth in this Program Directive, are applied to the Commissioner of the Department of Labor and Industry and/or to Virginia employers, the following federal terms if, and where they are used, shall be considered to read as below:

| Federal Terms | VOSH Equivalent |
|---|---|
| 29 CFR | VOSH Standard |
| Regional Administrator | Commissioner of Labor and Industry |
| Area Director | VOSH Director |
| Regional Solicitor | Attorney General |
| Agency | Department |
| Compliance Safety and Health Officer (CSHO) and/or Industrial Hygienist | CSHO |
| Field Inspection Reference Manual (FIRM) | VOSH Field Operations Manual (FOM) |

OSHA **Occupational Safety & Health Administration**
**U.S. Department of Labor**

# Special Emphasis Program (SEP) for SILICOSIS

**May 2, 1996**

**MEMORANDUM FOR: REGIONAL ADMINISTRATORS**

**FROM: JOSEPH A. DEAR**
**ASSISTANT SECRETARY**

**SUBJECT: Special Emphasis Program (SEP) for SILICOSIS**

This memorandum provides inspection targeting guidance for implementing and OSHA-wide Special Emphasis Program (SEP) to reduce and eliminate the workplace incidence of silicosis from exposure to crystalline silica. The policy set forth in this memorandum is effective immediately. This SEP covers most SIC codes where an exposure to crystalline silica may exist. Inspections initiated under this SEP shall be scheduled and conducted in accordance with the provisions in the Field Information Reference Manual (FIRM) and the Revised Field Operations Manual (FOM).(1,2) Regional Administrators and Area Directors shall ensure that the procedures established in this memorandum are adhered to in the scheduling of programmed inspections. Regional Administrators shall also ensure that the State Consultation Program Managers and the State Plan State Designees in their Regions are appraised and aware of the contents of this SEP and ts required Area Office outreach initiatives. In all Federal enforcement states, and state plan states which adopt this program policy, Regional Administrators are to encourage the Consultation Programs' full cooperation and assistance in this Agency-wide effort.

Background information on crystalline silica and silicosis can be found in Appendix A to this document.

## Procedures

1. **General Industry Targeting:**

Inspections conducted under this special emphasis program shall be scheduled and conducted under the priorities listed below. Wherever possible (data permits) inspections shall be focused to particular establishments where overexposures to crystalline silica are most likely or there are known cases of silicosis. In looking at records mentioned below be advised that a diagnosis of

silicosis may include such terminology as pneumoconiosis, fibrosis, respiratory disease, non-malignant respiratory disease, or even congenital heart failure.

The following are suggestions for obtaining information to target inspections at particular establishments or SIC Codes. Area Offices shall determine if any of these suggestions are applicable to their areas and shall attempt to obtain and use such data. The data sources have been prioritized based upon what is considered most beneficial.

**Note:** In some cases the use of the data may involve lengthy discussions and preparation of Memorandums of Understanding with the respective agency.

- For Area and Regional Offices that have workers compensation data, it shall be evaluated for trigger entries such as silicosis, pulmonary fibrosis, fibrosis, nonmalignant respiratory disease, pulmonary edema, congenital heart failure, and/or scarring of the lungs. Data obtained from this source shall be examined and compared with likely SIC Codes for a determination of whether there is a potential for exposure to silica.

- Cross referencing of Agency-collected OSHA 200 data with SIC data may produce inspection sites for the SEP. The Office of Statistics can be contacted to determine the status of the data and the potential for matching certain SIC codes with specific employers. Bear in mind that, this is in the early development phase and will not likely be a good source during the early implementation of this SEP.

- SENSOR Data (Sentinel Event Notification Systems for Occupational Risks) is a NIOSH program of cooperative agreements with state health departments to develop models for state-based occupational disease surveillance programs. There are 11 current cooperative agreements for FY 1995. The program is collecting silicosis data in Illinois, Michigan, North Carolina, New Jersey, Ohio, Texas, and Wisconsin. The Office of Health Compliance can provide the names and phone number/address of state contact persons.

- State Surveillance Systems. Many states have such programs in place. As these become more popular they could represent our best source of data.

- Contacts with local trade unions, especially those involved with painting may provide information useful to developing a targeting system.

- Hospital Discharge Data. This source may represent a valuable source of data as hospitals sometimes obtain patient work histories. Rosenman (1988), has considerate work on this and can be referred to for more specific information.(3)

- Registry of Occupational Safety and Health (ROSH) data. The Bureau of Labor Statistics (BLS) has been collecting data and has set up special coding for crystalline silica. The BLS can be contacted to obtain this data which cross references with SIC Codes.

- Review of local or area morbidity statistics.

- Other possible sources include contacting pulmonary specialists and discussing silica and silicosis with them. Occupational health clinics, can be contacted as well as occupational physicians. One can also contact the Association of Occupational and Environmental Clinics (AOEC) at (202) 347-4976 for clinics in jurisdictional areas.

- The reference list for this memorandum also contains a variety of articles that show different sources of data that can be used in establishing inspection lists.

- Chemical Use Inventories - This is under development by the EPA. Potentially, the database will contain chemical, site specific information which can be used for targeting. Some states (New Jersey) may already have some form of this in place.

2. **Construction Targeting (including maritime where applicable):**

In construction, activities such as jack hammering, rock drilling, abrasive blasting, concrete mixing, concrete drilling, brick and concrete block or slab cutting, and guniting are associated with potential exposure to crystalline silica dust.(4) The following points are suggested sources to obtain construction targeting information.

- Data sources found under general industry targeting may be utilized where feasible

- Visual observations of potential crystalline silica generating processes such as rock drilling or abrasive blasting

- Targeting with known high silica hazard operations such as abrasive blasting or rock/well drilling. The local telephone books can be utilized to develop source lists.

- Dodge reports

- Construction activity reports from the University of Tennessee

- Appendix B, contains a list of construction SIC codes where OSHA sampling has found overexposures.

- Review of the "Construction Safety and Health State of the Art Reviews" (1995)(5)

Where CSHOs utilize visual observations for targeting of construction related inspections the following shall be followed:

A. Whenever a CSHO observes or receives information, the CSHO shall:

1. Document the status and condition of the work operation as far as it is known, noting any serious hazards.

2. Note the name and address and location of the worksite or facility and, in construction, the name of the contractor(s) performing the work.

3. Provide the Area Office Supervisor or Area Director with the information. Based upon the information provided, all potential crystalline silica dust exposures brought to the attention of the Area Office shall be inspected as follows:

   - If the worksite has been inspected within the last 30 days, the results of the inspection shall be considered along with the current worksite observations in determining whether or not an inspection is to be conducted.

   - If the crystalline silica dust generating work was not in progress during the previous visit to the site but is currently in progress the inspection shall be authorized and opened.

   - If the crystalline silica dust generating work was in progress and evaluated during the previous inspection, the inspection will be opened only if apparent serious violations are present or can reasonably be expected at the site.

   - If the worksite has not been inspected within the previous 30 days, an inspection shall be conducted unless it is apparent that workers are not exposed to crystalline silica dust.

B. Documentation of the events leading up to the observation shall be maintained by the Area Office in case of a denial of entry.

3. For Area Offices that cannot develop a site specific inspection list from the examples in No. 1, a list of industries under their jurisdiction likely to be involved in crystalline silica-related activities and exposures shall be developed. The tables presented in Appendix B include SIC codes prepared from OSHA's IMIS data. The two tables represent lists of SIC codes where sampling was conducted and where over exposures to crystalline silica were documented. These lists can be used as a starting point for Area Offices to develop a list of SIC Codes and facilities under their jurisdiction where there is the most likely potential for worker silica exposure.

4. Inspection sites using any of the previously discussed methods shall be randomly selected for inspection using a random numbers table. This selection process sets forth administratively neutral criteria to identify establishments for inspection. Area Offices and Regions may first want to cull the list to remove sites recently evaluated or not likely to have hazards associated with crystalline silica. Some lists generated using 4 digit SIC codes will produce sites clearly not likely to have the hazard present.

5. **Focused Inspections**: As with focused inspections in construction(6), those sites targeted for inspection that have implemented an effective and ongoing silicosis prevention program can be exited after the program review. The silicosis prevention program may appear as or be part of the establishment's overall safety and health program. If the facility appears to qualify for a focused inspection based upon management interviews and company documentation the CSHO will verify the program through a brief walkthrough and employee interviews. The CSHO, prior to leaving the facility, shall document that his or her initial review of the site's safety and health program or the site's crystalline silica control program found that the program elements were appropriate and fully effective in providing protection to the affected workers.

The following is a list of elements which may be included in an effective program [Note: In a facility where exposures are below the permissible exposure limit, CSHOs, for education and information purposes, should make the employer aware of elements that should be included in an effective crystalline silica control program in order to provide employees at the establishment protection from possible crystalline silica over exposure(s).]:

- ongoing personal air monitoring program*
- ongoing medical surveillance program
- training and information to workers on crystalline silica*
- availability of air and medical surveillance data to workers*
- an effective respiratory protection program*
- hygiene facilities and clothing change areas
- appropriate recordkeeping*
- personal exposures below the PEL or the facility has an abatement
- program that also provides for interim worker protection

- housekeeping program*
- in construction - a safety and health program*
- regulated areas*
- Required by specific OSHA standards if an overexposure to crystalline silica exists.

6. This SEP is a nationwide initiative with participation by all Regions and Area Offices. In the case of locally developed Cooperative Compliance Programs such as the Maine 200, the Wisconsin 200, the New Hampshire 50, or other programs developed by redesigned Area Offices, the offices shall work this SEP into their programs.

7. Regions are to begin conducting inspections under this SEP immediately following 60 days of outreach activities. (See Full Service Program Support beginning on page 11.)

8. In construction and maritime, where resources permit, a joint safety and health inspection should be conducted. Referrals to safety compliance officers where appropriate shall be submitted.

9. If CSHOs find a product that contains crystalline silica and downstream exposure is reasonably anticipated (sawing or cutting of brick, tiles, and concrete blocks), they should investigate the adequacy of the material safety data sheets (MSDS) and product labeling. For example, concrete blocks have been found with labels stating "caution, irritant dust", and the MSDS did not address accurately the chronic health hazard.

**Application**

1. Inspections under this SEP shall address areas of potential crystalline silica dust-related overexposures where there is an increased risk of silicosis. Inspections will include a review of written documentation (i.e. recordkeeping, air monitoring, medical examinations or evaluations, respirator protection, engineering and/or work practice controls, hazard communication, MSD sheets, and training). The CSHO may expand the inspection scope beyond the crystalline silica-related activities if hazards or violations are observed (FIRM CH. II-1).(1)

   Note: If the CSHO, based upon professional judgment or sufficient employer monitoring data, determines that employees are not overexposed to crystalline silica the CSHO can close and move to another job site. Prior to exiting, the CSHO should discuss the employer's silica program and provide suggestions and information where appropriate.

2. CSHOs shall question employers to determine whether the employer has conducted personal or area sampling for dust containing crystalline silica. Where such data has been collected copies of the data shall be obtained. CSHO's will also interview the employer to determine whether the employer has conducted any medical surveillance

of exposed employees. If such surveillance records exist, copies of the records shall be obtained where necessary to support a violation (medical access orders shall be used where necessary).

Medical records should be reviewed in consultation with the Office of Occupational Medicine. Appendix C contains recommendations for medical evaluations related to crystalline silica exposure as well as suggestions for a medical monitoring program. Regardless of the level of exposure to crystalline silica, CSHOs should make Appendix C available to the employer.

3. CSHOs shall conduct personal employee monitoring and collect appropriate bulk samples where appropriate to document exposures unless the inspection focused or the employer has documented that no overexposure exists.

4. While evaluating worker exposures to dust containing crystalline silica during abrasive blasting, CSHOs shall also be aware of and evaluate potential exposures to **noise and metals**. Metal exposures often associated with abrasive blasting include but are not limited to: **lead, arsenic, manganese, chromium, cadmium, copper, and magnesium**.

   Worker clothing contaminated with crystalline silica dust can be carried home and potentially expose family members. Worksites where this potential is observed by the CSHO should be evaluated (including automobiles) and the employer and employee representatives made aware of the hazard of such activity.

5. Citations and classification of violations for overexposures to crystalline silica dust, for respiratory protection, and for work practice and/or engineering controls shall be issued in accordance with the procedures and requirements of the FIRM.(1)

6. For examples of standards that contribute in controlling potential exposures to crystalline silica please refer to Appendix D.

**Sampling and Laboratory Submission of Samples**

The exposure monitoring shall consist of personal respirable dust samples collected from the worker's breathing zone. Exposure monitoring shall be conducted in accordance with The OSHA Technical manual TED 1.15 and with OSHA Instruction CPL. 2-2.43A, the Chemical Information file (noted as Chemical Sampling Information on the OSHA CD).(6) As a reminder, all collected samples shall be pre- and post-weighed by the CSHO in accordance with standard agency procedures. The SLTC is now providing filter weighing services to the field. To use the pre-weighed filters supplied by the SLTC with the 10-mm nylon cyclone sampling device assembly, the field must obtain a plastic coupler [contact the SLTC or the Cincinnati Technical Center (CTC) for further information]. The pre-weighed filters can be ordered either from the

SLTC or the CTC. If the CSHOs do not use the SLTC pre-weighed filters, they should pre- and post-weigh all collected samples according to the standard agency procedures. Samples shall be desiccated before conducting pre- and post-weighings. Filter cassettes with the 10 mm nylon sampling device will be placed in the workers breathing zone. Full shift samples shall be collected where possible. Sample air volumes of 408 to 816 liters are recommended. A sampling flow rate of 1.7 liters per minute +/- 0.2 liters per minute) should be used with the 10 mm nylon cyclone sampling device. CSHOs should refer to the OSHA Technical manual TED 1.15 for pump calibration information with cyclones.(6) Care needs to be taken to assure that the cyclones are not inadvertently inverted. CSHOs are to check pumps on at least an hourly basis, if possible, and note the flow rates, and document what the worker was doing at the time of the check. If filter overloading is suspected or workers change to another job or procedure, the CSHO shall replace the sampling filter with a new filter and document the time of the changes. Blank filters shall be obtained in accordance with standard procedures. For jobs that are of short duration such as in construction, CSHOs should request that the samples be expedited.(8)

Note: The SLTC will honor a request from a CSHO to have sample analyses "rushed" because of "a short term operation", "severe health problems", "union or media concern", or even if a limited number of samples need to be rushed for a "fast track screening".

Occasionally CSHOs will encounter a work situation where there is mixed exposure to quartz, cristobalite, and/or tridymite. In these situations, CSHOs, in addition to looking at the individual exposures, shall also apply the mixture formula found in Appendix E to the samples. Sampling for Bulks: For crystalline silica analysis, if available, bulk samples should be submitted to the laboratory under separate cover. Bulk samples can be collected through a variety of means. A bulk, high volume, respirable sample may be the most ideal of the bulk samples. However, this type of bulk sample may not be as practical to collect as a settled dust sample or a sample of the raw materials. The following bulk sample methods are listed in the ideal order of preference:(8)

1. High volume respirable filter sample (preferably > 1.0 grams). Contact the SLTC for information on this.

2. High volume filter sample - nonrespirable (preferably > 1.0 grams)

3. Representative of settled dust [i.e. rafter sample (preferably > 1.0 grams)].

4. Sample of the bulk material in the workplace - preferably 10-20 grams.

**Interferences**: Interferences can affect the laboratory analyses. However in the vast majority of cases, interferants do not prevent analyses. The SLTC uses X-ray diffraction to analyze for quartz and uses the three most sensitive peaks to minimize interferences and provide conclusive identification. To assist the laboratory, list any potential interferences on the OSHA 91A Form submitted with the samples. In addition, the CSHO should include a copy of the material safety

data sheet for the silica containing material if available. Potential interferences on one or more peaks for crystalline silica analyses include but are not limited to the following:(8)

aluminum phosphate
biotite (mica)
clinoferrosilite
feldspar (some)
graphite
high albite
iron carbide
lead chromate
lead sulfate
leucite
microcline
muscovite (mica)
orthoclase
potassium hydroxide
sanidine
sillimanite
wollastonite
zircon

**Special Procedures for Construction and Maritime**

The crystalline silica exposure limit for the construction and maritime trades in 29 CFR Parts 1926 and 1915 are expressed in terms of millions of particles (of dust) per cubic foot (MPPCF), which is measured using an impinger sampling method. The impinger method of counting dust particles is obsolete, and comparative sampling has established that the formula of 250/[(% quartz) + 5] which sets the mppcf exposure limit described in the maritime and construction standards is equivalent to the general industry PEL of:

$$\frac{10 \text{ mg/m(3)}}{\text{\% Quartz) + 2}}$$

Therefore the same gravimetric sampling method and the general industry PEL formula should be used in all industries. This evidence is discussed more fully in Appendix F.

**Recording in the IMIS**

Current instructions for completing enforcement forms OSHA-1, OSHA-7, OSHA-36, and OSHA-90 and Consultation Request Form-20 and Visit Form-30 shall be applied when recording inspections conducted under this SEP as follows:

1. The OSHA-1 Form for any programmed inspection covered under this special emphasis program for crystalline silica in all industries shall be marked "PLANNED" (Item 24h) and "SPECIAL EMPHASIS PROGRAM" (Item 25d) Record **SILICA** in the space in item 25d.

2. The OSHA-1 Form for any unprogrammed inspection shall be marked as unprogrammed (Item 24a. through g. as appropriate). In addition, it shall be marked "SPECIAL EMPHASIS PROGRAM" (Item 25d). Record **SILICA** in the space in Item 25d.

3. For focused inspections covered under this SEP, Item 42 (Optional Information) of the OSHA 1 Form shall be completed according to the guidelines outlined in the memorandum of March 10, 1995, detailing the proper coding for focused inspections (see Appendix G).

4. Whenever an OSHA-7 is completed by a Federal office and the applicable complaint alleges the presence of crystalline silica or related silicates, complete the OSHA-7 in the normal manner, but include the code for silica in "Optional Information" Item No. 46. The following format should be used:

```
TYPE     ID     VALUE
    ----      --      ------
     N        16      SILICA
```

5. Whenever an OSHA-36 is completed by a Federal office and the inspecting compliance officer(s) is/are able to identify at the site of the fatality/catastrophe the presence of crystalline silica or related silicates, complete the OSHA-36 in the normal manner, but include the code for silica in "Optional Information" Item No. 35. The following format should be used:

```
TYPE    ID      VALUE
       ----     --      ------
     N       16      SILICA
```

6. Complete the OSHA-90 in the normal manner and enter the code "SILICA" in "Optional Information" Item No. 26, when an OSHA-90 is completed by a Federal office and the applicable referral case has crystalline silica as one of the subject of the file. The following format should be used:

| TYPE | ID | VALUE |
|---|---|---|
| N | 16 | SILICA |

**Consultation**

Whenever a visit is made in response to this SEP, Consultation Request, and/or Visit forms are to be completed as follows:

1. Complete the Request Form-20 in the normal manner and enter the code "SILICA" in "Optional Information", Item No. 26, when a visit has been made in response to the SEP. The following Information should be used:

| TYPE | ID | VALUE |
|---|---|---|
| N | 16 | SILICA |

2. Complete the Visit Form-30 in the normal manner and enter the code "SILICA" in "Optional Information", Item No. 34, when a visit has been made in response to the SEP. The following Information should be used:

| TYPE | ID | VALUE |
|---|---|---|
| N | 16 | SILICA |

**Full Service Program Support**

Each Area Office/Region is encouraged to develop outreach programs that will support the enforcement effort. Such program could include letters to employers, professional associations, the Associated General Contractors (AGC), local unions, Associated Builders and Contractors, local safety councils, apprenticeship programs, local hospitals and occupational health clinics, and/or other industry employer organizations that work with or potentially generate crystalline silica dust. Speeches, training sessions, and/or news releases through the local news papers, safety councils and/or industrial hygiene organizations can provide another avenue for dissemination of information. A generalized crystalline silica/SEP news release will be prepared by the National Office and made available to each Region. All OSHA Consultation Program offices will be provided with a copy of the SEP memorandum. In those states which are participating in the program, Regional Administrators shall ensure the coordination between Area Directors and the State Consultation Program manager to encourage their assistance in

outreach efforts in support of this program. Existing local silica/silicosis expertise within state Consultation program office may provide valuable assistance to the Area Office staff in their various outreach efforts. Consultation projects may also have already developed or have available to them written, audio visual, or materials in other formats on working safely with silica and/or worker safety and health training materials that may be helpful to the Area Office. State Consultation projects are provided specific instruction in this document for coding consultative visits made for requests for assistance in response to this SEP. Requests for Consultative visits from employers as a result of OSHAs Silicosis SEP are to be given priority over other visit requests, as appropriate. The Office of Health Compliance Assistance in conjunction with the OSHA Training Institute will develop crystalline silica related information and training materials. This information will be made available to the Regional Offices for distribution to their respective field offices. Area Offices are encouraged to develop a list of industries and contractors involved in crystalline silica related work and potential exposures. Once the list has been generated, each entry can be contacted (if resources permit) in writing and provided with a copy of this memorandum and general information available about crystalline silica. To assist the Agency in outreach, Area and Regional Offices through the Silica SEP Coordinator should be compiling a list of frequently asked questions (FAQs) that are received a long with their full responses. These FAQs would then be periodically forwarded to the Office of Health Compliance Assistance. The FAQs could include questions like the following:

1. How does the OSHA PEL of 10/(% Quartz + 2) compare to the ACGIH TLV of 0.1 mg/m(3) or the NIOSH REL of 0.05 mg/m(3)?

2. How do I perform a mixture calculation if the sample contains both quartz and cristobalite?

3. How are we able to use a PVC filter with a 5 um pore size to capture down to submicron size dust?

4. Can I sample using low ash 0.4 um pore size AA (MCEF) filters instead of low ash PVC filters?

5. Why do we use nylon cyclones rather than metal cyclones?

6. How do I perform a leak test of the cyclone?

**Measuring Agency Impact**

Each Region shall designate an individual as the silica SEP Coordinator. The identified individual shall coordinate crystalline silica inspection activities and work with the Office of Health Compliance Assistance to collect and evaluate the effect and success of this program. Measuring Agency impact can be broken down into an interim component and a final component. In the interim, the Office of Health Compliance Assistance will collect and evaluate IMIS data through coding on the OSHA-1 for this SEP. In the long-term, the Regional Silica

Coordinator in conjunction with the Office of Health Compliance Assistance will collect information on the development of new and feasible engineering and work practice control techniques, controls through substitution with other materials (for example some nonferrous foundries have found that with equipment modification they can use olivine sand), in place of silica sand, medical programs implemented, airborne personal monitoring programs in place, examples of silica control plans or exemplary workplace safety and health programs with effective silica control program elements, numbers of inspections that were focused, and the like. Area Offices or the Regions, under this SEP, will need to maintain a file containing abatement information from their inspections and a summary of any medical programs related to silica exposure in effect. The data shall include both recommended and implemented abatement information for the specific type of operation that was evaluated. Such information shall also include a reference to the inspection number. This program will run through Fiscal Year 1997. At the end of Fiscal Year 1997 the program will be regionally evaluated by each Regional Silica Coordinator. A written evaluation will be submitted to the Director of the Office of Health Compliance Assistance discussing the program operation in their respective Regions, the effectiveness, problems encountered, any recommendations for changes or additions to the program, and finally a recommendation on whether or not to continue the program. The Office of Health Compliance Assistance will evaluate these Regional Report and will make a recommendation to the Director of Compliance Programs on whether or not to continue the program. A final report on the program will be prepared by the Office of Health Compliance Assistance evaluating the effectiveness of this SEP.

**Federal Program Change**

This is a federal program change that impacts state programs. The Regional Administrator (RA) shall ensure that this change is promptly forwarded to each state designee using a format consistent with the Plan Change Two-way Memorandum in Appendix A, OSHA Instruction STP 2.22A, State Plan Policies and Procedures Manual (SPM). The RA shall explain the content of this change to the state designees. States are encouraged, but not required, to adopt an identical or alternative policy. States shall be asked to provide preliminary notification to the RA within 30 days from the date of this instruction of their intent to adopt or not to adopt the SEP established by this memorandum. The state shall formally respond to this change with an indication of its final determination within 70 days in accordance with paragraph I.1.a.(2).(a). and (b), Chapter III of Part I of the SPM. If the state adopts identical compliance procedures, the Plan Change Two-way Memorandum plus a copy of the state's cover memo or directive transmitting these procedures to its field staff will suffice as the plan supplement. If the state adopts different compliance procedures, a copy of the procedures shall be provided to the RA within six (6) months from the date of this memorandum. In those state plan states where the PEL in construction or maritime is the same as OSHAs (units in MPPCF) the states are urged to follow the procedures spelled out in Appendix F. States are also strongly encouraged to use all the sampling and analytical methods in this memorandum when they evaluate crystalline silica, regardless of whether they adopt the SEP. These procedures are the same as those in the OSHA Technical Manual. As with any complex sampling procedures, states not having the necessary laboratory equipment for the analyses may contact the Salt Lake City Laboratory for assistance. The RA shall review policy, procedures, and instructions issued by the state and monitor their

implementation as provided in a performance agreement or through routine monitoring focusing on impact and results.

Distribution: National, Regional, and Area Offices
All Compliance Officers
State Designees
State Consultation Project Managers
NIOSH regional Program Directors
MSHA

## Appendix A

### Background: Crystalline Silica and Silicosis

Crystalline silica is a ubiquitous substance which is the basic component of sand, quartz and granite rock.(9) Airborne crystalline silica occurs commonly in both the work and non-work environments. Occupational exposure to crystalline silica dust has long been known to produce silicosis, a pneumoconiosis or dust disease of the lung. Activities such as sandblasting, rock drilling, roof bolting, foundry work, stonecutting, drilling, quarrying, brick/block/concrete cutting, gunite operations, lead-based paint encapsulant applications, and tunneling through the earth's crust can create an airborne silica exposure hazard. In addition some recently noted exposures to crystalline silica include the following:

- Calcined diatomaceous earth can contain anywhere from <1% to 75% cristobalite. In addition to use as a filtering media, calcined diatomaceous earth is often used in industries such as food and beverage preparation where only food grade products and equipment can come in contact with foods or beverages being made.

- Asphalt paving manufacturing may also be a source of crystalline silica exposure, due to the mechanical formation of crystalline silica dust when sand and aggregate passes through rotary dryers. The fine dust can have significant amounts of crystalline silica, depending upon the source of the aggregate. For example, rotary drying of gravel from the Willamette river in Oregon was found to generate dust containing approximately 7 to 12% quartz. The waste dust was transferred periodically by front loader, resulting in clouds of visible dust drifting to the operator.

- The repair or replacement of linings of rotary kilns found in pulp and paper mills and in other manufacturing locations as well as the linings in cupola furnaces are potential sources of crystalline silica exposure. This work may not be commonly seen due to the infrequency and less visible nature of the work location. Turnarounds and yearly shutdowns are the time when this work commonly occurs.

- In food processing operations where crops such as potatoes and beans are readied for market, silica overexposures have been documented in the sorting, grading and washing areas.

Geologically, quartz is the second most common mineral in the earth's crust. Quartz is readily found in both sedimentary and igneous rocks. Quartz content can vary greatly among different rock types, for example: granite can contain anywhere from 10 to 40 percent quartz; shales have been found to average approximately 22 percent quartz; and sandstones can average almost 70 percent quartz. Silica is a general term for the compound silicon dioxide (SiO(2)). Silica can be crystalline or amorphous. Different crystalline silica structures exist as polymorphs of silica and include quartz and less common forms such as cristobalite and tridymite. The latter two are less stable than quartz which accounts for the dominance of the quartz form. Quartz can exist as two sub-polymorphs, a-quartz or low quartz, and B-quartz or high quartz. Of these two forms, a-

quartz is more common as the B-quartz is apparently only stable at temperatures above approximately 570 degrees centigrade. Upon cooling, B-quartz quickly converts to a-quartz. In the literature, crystalline silica is commonly referred to as silica sand, free-silica, quartz, cristobalite, and tripoli. When diatomaceous earth is subjected to pressure or is processed (calcined) at temperatures above 1000 degrees C some of the amorphous silica is converted to crystalline silica in the form of cristobalite.(11) Recent articles have documented the creation of cristobalite in "after-service" refractive ceramic fiber insulation.(12-14) Amorphous silica has been found to exist in nature as opal flint, siliceous glass, diatomaceous earth and vitreous silica.(15) Silicosis is one of the world's oldest known occupational diseases with reports dating back to ancient Greece. Since the 1800's, the silicotic health problems associated with crystalline silica dust exposure have been referred to under a variety of common names including: consumption, ganister disease, grinders' asthma, grinders' dust consumption, grinders' rot, grit consumption, masons' disease, miner's asthma, miner's phthisis, potters' rot, sewer disease, stonemason's disease, chalicosis, and shistosis. Silicosis was considered the most serious occupational hazard during the 1930's, and was the focus of major federal, state, and professional attention during this time.(10) The hazard is still present 60+ years later. Crystalline silica is commonly found and used in the following industries:

- electronics industry
- foundry industries
- ceramics, clay and pottery, stone, and glass industries
- construction
- agriculture
- maritime
- railroad industry (setting and laying track)
- slate and flint quarrying and flint crushing
- use and manufacture of abrasives
- manufacture of soaps and detergents
- mining industries.

Perhaps the most familiar use of quartz sand is as an abrasive blasting agent to remove surface coatings prior to repainting or treating. A recent alert published by the National Institute for Occupational Safety and Health (NIOSH) estimates that there are more than one million American workers that are at risk of developing silicosis. Of these workers, NIOSH further estimates that more than 100,000 are employed as sandblasters.(16) In the United States, from 1968 through 1990 the total number of deaths where silicosis was reported anywhere on the death certificate was 13,744. Of these, approximately 6,322 listed silicosis as the underlying cause of the death.(17) In this study, deaths in the United States due to silicosis was primarily concentrated in 12 states (California, Colorado, Florida, Illinois, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.) The silica-related deaths in these 12 states accounted for 68% of the total silica related deaths in the United States. By industry, construction accounted for 10% of the total silicosis-related deaths.(17) Based upon the wide spread occurrence and use of crystalline silica across the major industrial groups (maritime, agriculture, construction, and general industry), and in consideration of the number of silicosis

related deaths, the NIOSH estimates for the number of exposed workers, and the health effects of crystalline silica dust exposure (e.g., pulmonary fibrosis, lung and stomach cancer), the Agency is implementing a nationwide special emphasis program to assure worker protection from over exposure to crystalline silica dust.

**Health Effects of Silica Exposure**

Inhalation of crystalline silica-containing dusts has been associated with silicosis, chronic obstructive pulmonary disease, bronchitis, collagen vascular diseases, chronic granulomatous infections such as tuberculosis, and lung cancer. In general, aerosols of particulates can be deposited in the lungs. This can produce rapid or slow local tissue damage, eventual disease or physical plugging. Dust containing crystalline silica can cause formation of fibrosis (scar tissue) in the lungs.(9) The inhalation of free crystalline silicon dioxide (SiO(2)) can produce a fibrotic lung disease known as silicosis. Particle size, dust concentration and duration of dust exposure are important factors in determining the attack rate, latency period, incidence, rate of progression and outcome of disease. A higher attack rate and severity of silicosis is seen with heating crystalline silica-containing materials to greater than 800 degrees C to transform SiO(2) into tridymite and cristobalite (both of which occur naturally and are also found in synthetic silica preparations). High cristobalite concentration also result from direct conversion of diatomaceous earth following heat and/or pressure and can be found in the superficial layers of refractory brick which have been repeatedly subjected to contact with molten metal.(9)

NIOSH has classified three types of silicosis, these include acute, accelerated, and chronic.

**Acute Health Effects:** Intense crystalline silica exposure has resulted in outbreaks of acute silicosis referred to medically as silico-proteinosis or alveolar lipoproteinosis-like silicosis. Initially, crystalline silica particles produce an alveolitis (inflammation in the gas exchange area of the lung) which is characterized by sustained increases in the total number of alveolar cells, including macrophages, lymphocytes and neutrophils. The alveolitis has been found to progress to the characteristic nodular fibrosis of simple silicosis.

A rapid increase in the rate of synthesis and deposition of lung collagen has also been seen with the inhalation of crystalline silica particles. The collagen formed is unique to silicainduced luna disease and biochemically different from normal lung collagen.(18)

**Accelerated Health Effects:** Accelerated silicosis may occur with more intense exposure over 5 to 15 years. Fibrotic nodules are generally smaller and the massive fibrosis often occurs in the mid-zones in the lungs.

Acute and accelerated silicosis have been associated with abrasive blasters.

**Chronic Health Effects:** Chronic silicosis usually takes 20 to 45 years to develop as a result of prolonged exposure to free crystalline silica. Nodular lesions tend to form in the upper lobes. In the simple stage of silicosis, symptoms and impairment of pulmonary function are uncommon. If progressive massive fibrosis (PMF) forms from the coalescence of fibrotic nodules the disease usually progresses, even following removal from exposure. Symptoms of silicosis may not

develop for many years. Shortness of breath with exertion is the most common symptom of established silicosis. Cough and expectoration may develop with disease progression, especially in cigarette smokers. Wheezing typically only occurs when conditions such as chronic obstructive bronchitis or asthma are also present. Significant abnormality on a chest x-ray may not be seen until 15 to 20 years of exposure have occurred.

When advanced disease and progressive massive fibrosis are present there is distortion of the normal architecture of the lung. Airway obstruction may occur from contraction of the upper lobes of the lung. Emphysematous changes may develop in the lower lobes of the lung.(19)

**Cancer:** The issue of crystalline silica exposure and cancer is a complicated one with disagreement in the literature.(20) In worst case, exposure to respirable crystalline silica dust has been associated with lung cancer.(20-26) There also has been the suggestion of stomach cancer associated with ingestion of crystalline silica.(7) The International Agency for Research on crystalline line silica and Cancer (IARC) in examining the carcinogenesis of silica has published monographs regarding crystalline some silicates. IARC determined that there is sufficient evidence for carcinogenicity in experimental animals with limited evidence for carcinogenicity in humans and has classified silica as a 2B carcinogen.(21) IARC is in the prcess of revisiting the crystalline silica carcinogen issue based upon recent epidemiological studies.

Studies have demonstrated a statistically significant, doserelated increase in lung cancer in several occupationally exposed groups. Winter (1990) observed that the lung cancer risk for pottery workers increased with estimated cumulative exposure to low levels of silica found in potteries. Another study also found that the risk of lung cancer among pottery workers was related to exposure to silica, although the dose-response gradient was not significant (McLaughlin, et al., 1992). An adjustment for possibly confounding exposure to polycyclic aromatic hydrocarbons slightly raised the odds ratios for exposure to silica. This study also analyzed lung cancer risk in tin miners in China and found a significant trend of increasing risk of lung cancer with increasing cumulative respirable silica exposure. A significant dose-response relationship between death from lung cancer and silica dust particle-years has also been demonstrated for South African gold miners (Hnizdo and Sluis-Cremer, 1991). In this study a synergistic effect on lung cancer risk was found for silica exposure and smoking. Lung cancer risk among workers in the diatomaceous earth industry has been studied by Checkoway, et al. (1993). Results showed increasing risk gradients for lung cancer with cumulative exposure to crystalline silica. The authors felt that this finding indicated a causal relation. Several studies have demonstrated a relationship between the degree of silicosis disability and risk for lung cancer (Goldsmith, 1994). Since severity of silicosis reflects silica exposure, this may also indicate a dose-response relationship for silica exposure and lung cancer (Checkoway, 1993).

For additional information please refer to references No. 22-26.

**Note:** Due to the potential association between exposure to dust containing crystalline silica and the development of lung and stomach cancer, one may find facilities where the employer is evaluating or has evaluated this exposure using thoracic samplers. Thoracic dust is defined as that portion of inhaled dust that penetrates the larynx and is available for deposition within the airways of the thorax. Thoracic dust includes the

respirable raction. The collection of thoracic dust samples currently is not a method used by the Agency. Area Offices need to be aware that thoracic sampling devices are currently available and one may run across the use of these samplers during inspections, For more information one can consult with the OSHA Salt Lake Technical Center (SLTC) or the Office of Health Compliance Assistance.

## Appendix B

**SIC Codes where overexposures to crystalline silica dust have been documented(22)**

| SIC CODE | Industry Type |
|---|---|
| 0723 | Crop preparation services for market |
| 1542 | Nonresidential construction |
| 1622 | Bridge, tunnel, and elevated highway construction |
| 1629 | Heavy construction |
| 1721 | Painting and paper hanging |
| 1741 | Masonry and other stone work |
| 1799 | Special trades contractors |
| 3255 | Clay refractories |
| 3321-2 | Foundries |
| 3325 | Foundries |
| 3365 | Foundries |
| 3441 | Fabricated structural metal |
| 3443 | Fabricated plate work |
| 3479 | Metal coating and engraving and allied services. |
| 3543 | Industrial patterns |
| 3731 | Shipbuilding and repair |

**SIC Codes where sampling has been conducted for crystalline silica dust during the previous three years and overexposures were not found.**

| SIC CODE | Industry Type |
|---|---|
| 1389 | Oil and gas field services not elsewhere classified |
| 1611 | Highway and street construction |
| 1771 | Concrete work |
| 1793 | Glass and glazing work |
| 1794 | Excavation work |
| 1795 | Wrecking and demolition |
| 2851 | Paints, varnishes, lacquers, enamels, and allied products |

| | |
|---|---|
| 2951 | Asphalt paving mixtures and blocks |
| 3088 | Plastics plumbing fixtures |
| 3089 | Plastics products not elsewhere classified |
| 3251 | Brick and structural clay and tile |
| 3281 | Cut stone and stone products |
| 3264 | Porcelain electrical supplies |
| 3272 | Concrete products except brick and block |
| 3297 | Nonclay refractories |
| 3324 | Steel investment foundries |
| 3363 | Aluminum die castings |
| 3364 | Non-ferrous die castings |
| 3366 | Copper foundries |
| 3369 | Nonferrous foundries |
| 3431 | Enameled iron and metal sanitary ware |
| 3444 | Sheet metal works |
| 3492 | Fluid power valves and hose fittings |
| 3498 | Fabricated pipe and pipe fittings |
| 3523 | Farm machinery and equipment |
| 3533 | Oil and gas field machinery and equipment |
| 3561 | Pumps and pumping equipment |
| 3569 | General industrial machinery and equipment |
| 3599 | Industrial and commercial machinery and equipment not elsewhere classified |
| 3648 | Lighting equipment, not elsewhere classified |
| 3715 | Truck trailers |
| 3823 | Industrial instruments for measurement |
| 4789 | Transportation services |
| 5199 | Nondurable goods |
| 7261 | Funeral services and crematories |
| 7363 | Help supply services |
| 7538/9 | General automobile repair shops |
| 7699 | Repair shops and related services |

## Appendix C

**Medical protocol recommendations for exposure to crystalline silica: (28-48)**

**A.** MEDICAL EXAMINATIONS. The following are the recommended medical procedures for individuals chronically exposed to crystalline silica or for individuals who have received one or more severe acute exposures to crystalline silica.

1. A baseline examination which includes a medical and occupational history to elicit data on signs and symptoms of respiratory disease prior to exposure to crystalline silica. The medical examination emphasizing the respiratory system, should be repeated every five (5) years if under 20 years of exposure and every two (2) years if over 20 years of exposure. The medical examination should be repeated more frequently if respiratory symptoms develop or upon the recommendation of the examining physician.

2. A baseline chest x-ray should be obtained prior to employment with a follow-up every 5 years if under 20 years of exposure and every 2 years if over 20 years of exposure. A chest x-ray may be required more frequently if determined by the examining physician.

3. Pulmonary Function Tests (PFT): Should include FEV1 (forced expiratory volume in 1 second), FVC (forced vital capacity) and DLCO (diffusion lung capacity). PFTs should be obtained for baseline examination with PFTs repeated every 5 years if under 20 years of exposure and every 2 years if over 20 years of exposure. PFTs may be required more frequently is respirable symptoms develop or if recommended by the examining physician.

4. A chest x-ray should be obtained on employment termination.

**B.** MEDICAL MANAGEMENT The chest x-ray should be a chest roentgenogram (posteroanterior 14" x 17" or 14" x 14") classified according to the 1970 ILO International Classification of radiographs of Pneumoconiosis by a certified class "B" reader. The medical follow-up should include the following procedures:

1. With a positive chest x-ray (1/0 or greater) the worker should be placed in mandatory respiratory protection, or if already wearing a respirator, the program should be reevaluated to assure proper fit and that the elements of 29 CFR 1910.134 are being met.

2. The worker should be referred to a physician specializing in lung diseases

for a medical evaluation and medical monitoring as warranted by the examining physician. A written opinion from the examining physician as to whether the employee has any detected condition that would place the worker at an increased risk should be provided to the employer and employee, while specific medical findings remain confidential.

3. All medical test results should be discussed with the worker by the physician.

4. In accordance with 29 CFR 1910.20, medical records shall be maintained for at least 30 years following the employee's termination of employment, unless the employee is employed for less than one year and the records are provided to the employee upon termination.

## Appendix D

The following list of standards includes those standards, that may, under appropriate inspection conditions be cited for crystalline silica overexposure under this SEP. The standards listed below are for general industry, maritime, and construction standards.

| OSHA Requirement | Gen. Ind. Std. | Const. Std. | Maritime Std. |
|---|---|---|---|
| Respiratory protection | 1910.134 | 1926.103 | 1915.152 |
| Permissible exposure limit and controls | 1910.1000 | 1926.55 & .57 | 1915.1000 |
| Accident prevention & warning signs | 1910.145 | 1926.200 | -- |
| Access to employee exposure and medical records | 1910.20 | 1926.33 | 1915.1120 |
| OSHA 200 forms | 1904 | 1904, 1926.22 | 1904 |

| | | | |
|---|---|---|---|
| Abrasive blasting, breathing air, enclosures, controls | 1910.94 | 1926.28, 55, 95, 100, 101, 102, 103, and 300 | 1915.131, 133 151, 152, 153 and 1000 |
| Hygiene | 1910.141 | 1926.27 and 51 | 1915.97 |
| General PPE | 1910.132 | 1926.28, 95, 100-105 | 1915.151-154 |
| Hazard Communication | 1910.1200 | 1926.59 | 1915.1200 |
| Safety and Health program | -- | 1926.20 | -- |
| General training | -- | 1926.21 | -- |

## Appendix E

**Sample Calculation for a mixture of crystalline silica:(8)**

Two consecutive samples from the same employee taken from a combined exposure to crystalline silica dusts have the following results:

| Sample | Sampling Period (Min.) | Total volume (Liters) | Respirable weight (mg) | Respirable concentration Mg/m(3) | Laboratory results (%) |
|---|---|---|---|---|---|
| A | 238 | 405 | 0.855 | 2.1 | 5.2 quartz<br>2.3 cristobalite<br>ND tridymite |
| B | 192 | 326 | 0.619 | 1.9 | 4.8 quartz<br>1.7 cristobalite<br>ND tridymite |
| TOTAL | 430 | 731 | 1.474 | | |

ND = Non Detected

Calculation of the TWA from the sampling and analytical data:

Step No. 1: Calculate the percentage of quartz, cristobalite, and tridymite in the respirable particulate collected

a. Quartz:

$$\text{Percentage} = \frac{\text{(weight of quartz in Sample A) + (weight of quam in sample B) x (100)}}{\text{Total weight of respirable particulate collected}}$$

$$= \frac{0.52(0.855\text{ mg}) + 0.048(0.619\text{ mg}) \text{ x } (100)}{(0.855\text{ mg} + 0.619\text{ mg})}$$

$$= \frac{0.044\text{ mg} + 0.03\text{ mg x } (100)}{1.474\text{ mg}}$$

$$= \frac{0.074\text{ mg x } (100) = 0.05(100) = 5\%}{1.474\text{ mg}}$$

b. Cristobalite:

$$\text{Percentage} = \frac{\text{(wt. of cristobalite in sample A)+(wt. of Cristobalite in sample b)x(100)}}{\text{Total weight (wt.) of respirable particulate collected}}$$

$$= \frac{0.023(0.855\text{ mg}) + 0.017(0.619\text{ mg}) \text{ x } (100)}{1.474\text{ mg}}$$

$$= \frac{0.02\text{ mg} + 0.011\text{ mg x } (100)}{1.474\text{ mg}}$$

$$= \frac{0.031\text{ mg x } (100) = 0.021(100) = 2.1\% = 2\%}{1.474\text{ mg}}$$

c. Tridymite: None Detected = 0% Step No. 2 Calculate the PEL for the mixture (use the formula in the OSHA Technical manual Appendix I-1.5)

$$\text{PEL(mixture)} = \frac{10 \text{ mg/m(3)}}{[\ \%\ \text{quartz} + 2(\%\ \text{cristobalite}] + 2(\%\ \text{tridymite}) + 2]}$$

$$= \frac{10 \text{ mg/m(3)}}{[5.0 + 2(2.0) + 2(0) + 2]}$$

$$= \frac{10 = 0.91 \text{ mg/m(3)}}{11}$$

Step No. 3 Calculate the employee's exposure to respirable dust

$$\text{Exposure} = \frac{(\text{sample weight A} + \text{Sample weight B})}{\text{Total volume of air sampled}}$$

$$= \frac{(0.855 \text{ mg} + 0.619 \text{ mg})}{731 \text{ liters } (1 \text{ m(3)}/1000 \text{ liters})}$$

$$= 2.0 \text{ mg/m(3)}$$

Step No. 4 Adjust (where necessary) for sampling period less than 8-hours. Assume a zero exposure time for the sampling period remaining.

$$\text{Adjusted Exposure} = \frac{(2.0 \text{ mg/m(3)})(430 \text{ minutes}) + 0(50 \text{ minutes})}{480 \text{ minutes}}$$

$$= \frac{2.0 \text{ mg/m(3)}\ (430 \text{ minutes}) = 1.8 \text{ mg/m(3)}}{480 \text{ minutes}}$$

Step No. 5 Calculate the Severity of the exposure:

$$\text{Severity} = \frac{\text{Adjusted Exposure}}{\text{PEL (mixture)}}$$

$$= \frac{(1.8\ \text{mg/m(3)}) \quad = 2.0}{(0.91\ \text{mg/m(3)})}$$

If the result from Step 5 is greater than 1.0 than an overexposure to the mixture of crystalline silica exists.

## Appendix F

**Permissible Exposure Limits for Construction and Maritime:**

OSHA's silica standards, promulgated pursuant to section 6(a) of the OSH Act, adopted the identical 1968 (General Industry) and 1970 (construction and maritime) ACGIH TLVs, which were expressed in terms of mppcf, but contained a notification that ACGIH intended to begin to express the silica TLV in gravimetric (mg/m(3)) terms.(49-51) The 1968 and 1970 TLV tables therefore included two formulas.

$$\text{Formula No. 1:} \quad \text{PEL} = \frac{250 \quad \text{mppcf}}{(\%\ \text{quartz}) + 5}$$

or

$$\text{Formula No. 2:} \quad \text{PEL} = \frac{10 \quad \text{mg/m(3)}}{\%\ \text{quartz} + 2}$$

The 1968 and 1970 TLV documentation described the advantages of the newer gravimetric sampling method, which yields results expressed mg/m(3), over the impinger sampling method, which yields results expressed in mppcf.(49-51) These advantages include the gravimetric sampling method's ability to account for the particle size and respirability of collected dust, and the facts that only a single sample need be collected to determine both the quartz content and the concentration of the dust and that the samples do not need to be analyzed within 24 hours. Moreover, the results are likely to be more accurate because, unlike impinger samples, they will not be affected by the possible agglomeration of collected dust during processing. The documentation also explained that the two formulas provided equivalent limits, and stated

ACGIH's intent to drop the mppcf formula entirely from future TLV editions.(49-51) Beginning in 1972, silica TLVs have been expressed exclusively in gravimetric terms.(51) ACGIH made clear that the purpose of this change was to take account of improved sampling and analytical procedures, and not to change the TLV in any way:

> "The impinger method requiring a counting procedure for evaluating relative dustiness, although extremely valuable in judging dust reduction, falls short of the ideal in relevance to health hazard, in simplicity, in reproducibility, and in unit cost. By the use of size-selective (cyclones) sampling devices, a fraction of dust may be collected which is capable of penetrating to the gas-exchange portion of the lung, where long-term retention occurs. The concentration of airborne quartz in this size fraction should relate more closely to the degree of health hazard. Mass methods also have advantages in reproducibility, lower cost, and simplicity.
>
> Data on long-term quartz exposures and their effects, using respirable mass measurements of dust, are not yet available. However, comparisons of impinger-count concentration and respirable-mass concentration show that the 9-10 MPPCF of granite dust suggested by Russell contains 0.1 mg/m(3) of respirable quartz.(52) The formula, TLV = 10/(%respirable quartz) mg/m(3) generalizes this relationship to all percentages of quartz in respirable dust. If the TLV were used only for dust containing at least 5% quartz, the above TLV formula would be satisfactory, but to prevent excessively high respirable dust concentrations when the fraction of quartz in the dust is less than 5%, a constant has been added in the denominator, as with the counting TLV, giving the formula, TLV = 10/(% respirable quartz + 2) mg/m(3). The additive constant "2" limits the concentration of respirable dust with <1% quartz to 5 mg/m(3). The above TLV has been demonstrated to give evaluations comparable to the impinger method in foundry dust exposures (emphasis added).(53) Where agglomerates are a factor, the results by the respirable mass method are more closely related to the hazard."(51)
>
> OSHA's general industry standard, 29 C.F.R. 1910.1000, adopted in 1971, included both formulas as equivalent exposure limits. The construction and maritime standards, adopted in 1974, however, included only the mppcf formula. No reason was given for this distinction. In fact, OSHA's 1971 adoption of both formulas in its general industry standard makes clear the agency's agreement with ACGIH's position that the two formulas are substantively equivalent. Since the PELs were adopted, the impinger sampling method has been rendered obsolete by gravimetric sampling. OSHA is not aware of any government agencies or employers in this country that are currently using impinger sampling to assess worker exposure to dust containing crystalline silica, and impinger samples are generally recognized as being less reliable than gravimetric samples. OSHA has determined that sampling procedures in the construction and maritime industries should the same as in general industry, and that the mppcf PELs in 29 C.F.R. 1915.1000 and 1926.55(a) are equivalent to the mg/m(3) PEL in 29 C.F.R. 1910.1000.

## Appendix G:

March 10, 1995

MEMORANDUM FOR: REGIONAL ADMINISTRATORS
AREA DIRECTORS

FROM: JOHN B. MILES, JR., DIRECTOR
DIRECTORATE OF COMPLIANCE PROGRAMS

SUBJECT: CORRECTING CODING OF FOCUSED INSPECTIONS IN CONSTRUCTION

On February 21, 1995 a memorandum was sent to Regional Administrators amending paragraph B.12 of the Focused Inspections in Construction Instructional Materials detailing changes in how focused inspections are to be recorded in the IMIS. Due to the strict edit procedures that will be implemented on March 15 (see start of day message on February 27), Area Offices are requested to update all previous focused inspections in construction entered in the IMIS since October 1, 1994 according to the new instructions. These records must be updated to provide proper reporting of focused inspection data on micro-to-host, ad-hoc and standard reports and to allow modifications to existing records. An inspection scan report can be run for FY 95 inspections selecting an Optional Information N-14 to identify existing records. Please make sure you identify the controlling contractor and the subcontractors when multiple inspections occurred on a site.

Please follow exactly the instructions listed below for coding and updating focused inspections in construction. If you have any questions, please contact John Franklin at (202)219-4470.

### B. SPECIFIC GUIDELINES

12. For coding purposes on the OSHA-1, a Focused Inspection will be considered a partial inspection. The IMIS code for Focused Inspections shall include the identification of the controlling contractor (record **Focus, C** for the controlling contractor) and shall include a notation of the total number of contractors effected (i.e., controlling contractor plus subcontractors on the site). For example, if there is a controlling contractor and three subcontractors, the inspection of the controlling contractor shall be recorded as follows:

```
Type   ID      Value
----   --     -----------
 N     14     Focus, C, 4
```

For each subcontractor issued a citation on a focused inspection the subcontractor's inspection (record **Focus, S** for the subcontractor) shall be recorded as follows:

| Type | ID | Value |
|---|---|---|
| N | 14 | Focus, S |

## Appendix H: SEP References

### References Related to the SEP


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